

Eleven New Species, a New Variety, and a New Varietal Combination in the Fern Genera *Asplenium* and *Diplazium* in Central America

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ABSTRACT. The following new taxa of ferns, *Asplenium barclayanum*, *A. salicifolium* var. *aequilaterale*, *A. seileri*, *Diplazium atirrense* var. *lobulatum*, *D. chimuense*, *D. chiriquense*, *D. croatianum*, *D. gomezianum*, *D. hammelianum*, *D. matudae*, *D. moranii*, *D. panamense*, *D. tutense*, have been revealed through research carried out in the preparation of contributions for *Flora Mesoamericana*.

Asplenium barclayanum C. D. Adams, sp. nov.

TYPE: Costa Rica. Isla del Coco: "Cocos Island," 3–7 Apr. 1838, *Barclay* 2196 (holotype, BM). Figure 1.

Filix *A. cristati* Lam. affinis sed lamina basin versus sensim contracta, pinnis mediis lanceolatis (non oblongis), pinnula basali singulari libera 2–4-lobata, rhachidi viridialata, apicem versus ad 1 mm plusve dilatata differt.

Rhizome 1–3 × 0.2–0.4 cm, suberect or shortly creeping; scales 1–5 × 0.2–0.8 mm, elongate-deltate from a rounded auriculate base, tapered to a short hair tip, remotely denticulate, flat or slightly crispate, clathrate, dark brown or blackish with narrow paler margins, slightly lustrous, eventually retiform, clustered over rhizome apex and extending to base of petiole only; leaves 11–38 cm long, tufted or closely approximate; petiole 2–8 cm long, purplish or grayish brown, narrowly green-winged from near base, brittle with residual vascular shreds; blade 9–30 × 2–5.5 cm, 2-pinnate-pinnatifid, lanceolate, gradually narrowed to base, with apex shortly acuminate, nonconform; rachis green-winged adaxially, widening at pinna bases and laterally to ca. 1 mm or more overall below the tip, confluent with pinna-bases on the basiscopic side, rounded and purplish brown abaxially, becoming stramineous or green distally, with a few short glandular hairs near junctions with pinnae; pinnae 0.5–3 × 0.4–1.2 cm, the longest submedial, stalked to less than 1 mm long, 15–30 pairs, obliquely deltate to lanceolate in outline, with a distinct 2–4-lobed pinnule proximally on the acroscopic side and up to 6 uniform pairs of simple or shortly forked lobules; costae prominent adaxially, winged throughout; proximal pinnules 3–5 × 2–4 mm, subflabellate; terminal segment linear, ascending-lobulate; ultimate segments to ca. 4 × 1

mm, linear or oblong, obtuse or emarginate, herbaceous, glabrescent, scarcely discolorous; veinlets simple or 1-forked in the lobed segments, evident, ending in linear hydathodes well short of margins; sori 0.5–3 mm, solitary or double and sometimes continuous around the veinlet-tip; indusia 0.4–0.5 mm wide, hyaline, colorless or light brown with broadly rounded entire or shortly erose margin, gaping and pocketlike at maturity; spores ca. 42 × 30 μm, light brown, reniform-ellipsoid with loose, unsculptured, sparsely rugose perispore.

Paratypes. COSTA RICA. ISLA DEL COCO: along brook flowing into Wafer Bay, ca. 700 ft., abundant on walls of cliffs, 19 Apr. 1930, *Svenson* 339 (MO); rivulet flowing into Chatham Bay, Mar. 1970, *Gómez* 3337 (F); sin. loc., *Menzies* s.n. (K).

This species has been collected several times on the Isla del Coco and has been aligned with *Asplenium macraei* Hook. & Grev. (*Svenson*, 1938; *Gómez*, 1975). A sheet seen by *Svenson* at Kew and filed with the holotype of *A. macraei* carries a mixture of collections comprising a piece of *A. myriophyllum* from Galápagos, a small withered leaf collected by *Macrae* which may or may not be *A. macraei*, and three leaves of another *Asplenium*, annotated "*Asplenium* Owhyhee A. M.," which led *Svenson* to believe that his collection from Cocos Island was also *A. macraei*. It has been confirmed by E. W. Groves that these three leaves were not collected by *Macrae*, but rather by *Alexander Menzies* on Cocos Island on 26 Jan. 1795, and he agrees with me that they do not represent that species.

Asplenium macraei seems to be a polymorphic species within the Hawaiian Islands, but the type comes closer to *A. sciadophilum* Proctor than to *A. barclayanum*, which has the ultimate segments linear or elliptic, rather than oblanceolate-oblong, with more open evenly spaced sinuses and a more broadly winged upper rachis. Other species of the affinity of *A. cristatum*, but with the blade narrowed gradually to the base, are *A. cladolepton* Fée and *A. myriophyllum* (Sw.) C. Presl. They both differ from *A. barclayanum* in having up to seven pairs of pinnules per pinna rather than a single free proximal acroscopic pinnule on the larger pinnae.

Collections from Isla del Coco, cited by *Gómez*

(1975: 43), but which have not been seen for this study, are *Gómez* 4536 (CR, US), *Pittier* 16235 (GH), and *Snodgrass & Heller* 954 (GH).

Asplenium salicifolium* L. var. *aequilaterale (Christ) C. D. Adams, comb. nov. Basionym: *Asplenium auriculatum* Sw. var. *aequilaterale* Christ, Bull. Soc. Roy. Bot. Belgique 35: 197. 1896. TYPE: Costa Rica: *Biolley* 2672 (lectotype, selected here, BR).

This variety differs from the type variety by the petiole drying brown rather than grayish green; the pinnae being almost equilateral with rounded auricles on both acroscopic and basiscopic sides rather than strongly inequilateral with the proximal acroscopic margin rounded-auriculate and the basiscopic margin subrectangular; the pinnae being more numerous with up to 22 pairs instead of fewer than 17 pairs, and herbaceous and discolorous rather than subcoriaceous and concolorous.

Additional specimens examined. COSTA RICA. SAN JOSE: W part of montañas Jamaica, ca. 3 km NE of Bijagual de Turrubares, Carara Reserve, 9°45.5'N, 84°33'W, 500–600 m, 7 Aug. 1985, *Grayum et al.* 5834 (MO). PANAMA. LOS SANTOS: Loma Prieta, Cerro Grande, 800–900 m, 8 June 1967, *Lewis et al.* 2238 (MO).

***Asplenium seileri* C. D. Adams, sp. nov.** TYPE: El Salvador. Laguna Verde, terrestrial in forest, 1,650 m, *Seiler* 957 (holotype, F).

Filix A. otitis Link affinis sed pinnis minoribus (2–4 mm latis), marginibus crenis late rotundatis interdum emarginatis, textura submembranacea differt.

Rhizome 1–1.5(–4.5) × 0.2–0.3 cm, erect; scales 1.5–2.5(–3) × 0.4–0.7 mm, linear-lanceolate, tapered to a hair tip, flat or subcucullate, slightly sinuate, remotely denticulate, clathrate, dark brown or black, lustrous, extending in smaller forms to petiole; leaves 7.5–20 cm long, tufted, monomorphic; petiole 0.5–4 cm long, flexuous, green-marginate or winged to 0.25 mm wide from near base, dark purplish brown and lustrous abaxially, with few appressed septate hairs extending to rachis and abaxial surface of lamina, brittle, scarcely leaving vascular shreds; blade 7–17 × 1.4–2.3 cm, 1-pinnate, linear-elliptic, narrowed to base, the tip long-acuminate, nonconform pinnatifid, then linear-caudate, regularly crenate-serrate; rachis with 2 patent green adaxial wings (to ca. 0.2 mm wide) interrupted at junctions with pinnae and confluent with their margins, rounded and dark purplish brown abaxially; pinnae 4–12(–14) × 2–4 mm, the longest medial, shortly (less than 0.3 mm) cartilaginous-stalked to sessile only distally, 18–32 pairs, obliquely oblong, the lowest deflexed and subflabellately equilateral,



Figure 1. *Asplenium barclayanum* C. D. Adams.

the others inequilateral, the upper patent or slightly ascending, shortly auriculate on the acroscopic margin, the cuneate proximal margins mostly slightly excavate, the acroscopic edge ± contiguous with the rachis, the basiscopic extending at least halfway to the obtuse dentate tip, the other margins with 3–5 broadly rounded, sometimes emarginate, shallow crenations, the costae scarcely more prominent than the veins, submembranaceous, discolorous; veinlets mostly simple, a few 1-forked on the acroscopic side and 2-forked in the auricles, evident, ending in conspicuous elongate-clavate hydathodes well within the margins; sori 0.5–1.5(–2) mm, regularly disposed, extending into the caudate leaf apex, rarely double; indusia ca. 0.4 mm wide, hyaline, greenish or brownish, entire, folded back and often completely obscured by sporangia at maturity; spores 34–35 × 23–25 μm, light brown, reniform-ellipsoid with loose irregularly ridged echinulate perispore.

Paratypes. EL SALVADOR. AHUACHAPAN: terrestrial on forest floor, Sierra Apaneca, SW of Apaneca village, 1,600 m, *Molina R. & Montalvo* 21797 (F). COSTA RICA. PUNTARENAS: terrestrial, Upper Río Buru, *Gómez et al.* 21783 (MO).

The name *Asplenium vicentinum* Maxon was used for this species by Standley & Calderón (1925: 21) and Calderón & Standley (1944: 29), based on *Standley 21574* (US), and Seiler (1980: 49) in lists. These uses were not accompanied by descriptions, and I have been unable to ascertain that the binomial was formally published elsewhere.

Diplazium atirrense (J. D. Smith) Lellinger var. **lobulatum** C. D. Adams, var. nov. TYPE: Costa Rica. Alajuela: Finca Los Ensayos, ca. 11 mi. NW of Zarcero, 850 m, 15 Aug. 1977, *Croat 43638* (holotype, MO; isotype, MEXU).

Pinnae per $\frac{1}{3}$ – $\frac{1}{2}$ distantiae ad costam in segmenta rotundata cum areolis costalibus saepe consociata partitae.

Paratypes. COSTA RICA. PUNTARENAS: Cañas Gordas, Valle de Agua Buena, 1,100 m, Feb. 1897, *Pittier 10968* (BR). PANAMA. CHIRIQUI: along road between Gualaca and Fortuna Dam site, 10.1 mi. NW of Los Planes de Hornito, 1,260 m, 82°17'W, 8°45'N, 10 Apr. 1980, *Antonio 4176* (MO); same locality, *Croat 50043* (MO).

The new variety is distinguished from variety *atirrense* by having the pinnae, at least at the base of the leaf, divided $\frac{1}{3}$ – $\frac{1}{2}$ of the distance from the margin to the costa into round-tipped segments, which are often associated with costal areoles. The typical variety has entire or subentire pinnae and forms regular flattened areoles along the mid-upper rachis-wing and elsewhere only casually.

Diplazium chimuense C. D. Adams, sp. nov. TYPE: Costa Rica. Limón: ridge between Cerro Chimú and Cerro Matama, terrestrial, 1,200 m, 29 Apr. 1985, *Gómez & Herrera 23544* (holotype, MO). Figure 2.

Diplazium foliis pinnatis, pinnis lateralibus subintegris 2–5-jugatis; pinna terminali libera 1–2-lobata, venulis anastomosantibus.

Rhizome ca. 1 cm thick, suberect; scales ca. 7×2.5 mm, ovate, shortly acuminate, somewhat saccate, with irregularly toothed margins, dark brown, clathrate, fenestrated, glossy; leaves 40–80 cm long, loosely tufted; petiole 18–40 \times ca. 0.2 cm, purplish brown, scaly and darker near base, like the rachis and costae puberulous; blade 22–40 \times 14–20 cm, 1-pinnate, ovate-deltate, acuminate; lateral pinnae 10–14 \times 3.5–4.5 cm, 2–4(–5) pairs, oblong-lanceolate, broadly and slightly unequally cuneate to subtruncate or rounded at base with stalk to 6 mm, the margins shallowly sinuate, the short- or long-acuminate tip subentire with minute serrations obscured by downfolding; terminal pinna 16.5–18 \times 4–5.5 cm (not including width of basal lobes), lanceolate, acuminate, with 1 or 2 ovate, acuminate basal lobes; lamina glabrous; midribs corrugate and

glabrescent abaxially; adaxial groove narrow, puberulous within, winged on both margins; veinlet-groups about 20 on each side of costa, 2–4(–5)-forked, with anastomoses between adjacent proximal branches more frequent toward the margin; veinlet-groups toward base of terminal pinna pinnate, up to 10-forked; sori to 15 mm, often linked on proximal veinlets, mostly double; indusia 0.3–0.4 mm wide including margin, fimbriate and ciliate with septate hairs, brown, glossy.

Paratypes. COSTA RICA. ALAJUELA: Univ. of San Ramón's Biological Field Station, ca. 20 km N of San Ramón, cloud forest, 10°15'N, 84°30'W, 800–900 m, 27 Feb. 1988, *Moran 4150* (MO, UC). HEREDIA: forest between Río Peje and Río Sardinalito, Atlantic slope of Volcan Barva, locally common on slopes in rich primary forest, 10°17.5'N, 84°04.5'W, 700–750 m, 2 Apr. 1986, *Grayum 6679* (MO, UC); ca. 30 km from San Ramón on road to Los Angeles Norte, wet cloud forest, ca. 2,000 ft., 10 July 1972, *McAlpin 1308* (CAS).

Among the Central American species with anastomosing veinlets, this is the only one with several pairs of entire lateral pinnae and a more or less conform terminal pinna.

Diplazium chiriquense C. D. Adams, sp. nov. TYPE: Panama. Chiriquí: Bajo Boquete, Finca de T. Rios, terrestrial on bank of streamlet, 2,000 m, 7 Sep. 1982, *Caballero 200* (holotype, MO). Figure 3.

Filix *D. franconis* Liebm. affinis sed stipite rhachidique brunnea (non straminea) et multo magis squamata, pinulis vel pinnularum segmentis paribus 7–11 (non 13–15 plusve) disposita, etiam pinnis prope bases gemmiferis differt.

Rhizome to 7×2 cm, erect or ascending; scales 3–10 \times 1–2.5 mm, lanceolate, acuminate, subentire or glandular-denticulate, twisted and curled, brown or blackish brown, subclathrate; leaves 45–120 cm, openly tufted in a short spiral; petiole 20–55 \times 0.2–0.5 cm, like rachis and costae brown or reddish brown, glabrous; scales at base of petiole spreading, clathrate, extending in smaller ragged, deltate, or polygonal forms to costules and veins abaxially; adaxial groove sparsely puberulous, glabrescent or with a few dark hairlike scales; blade 25–75 \times 10–27 cm, 2-pinnate or 2-pinnate-pinnatifid (proximally at base), ovate-lanceolate, long-acute; pinnae 4–13(–16) \times 1.5–4(–5.5) cm, 12–16(–18) pairs, lanceolate, usually alternate, long-caudate acuminate, the basal slightly shorter, stalked to 4 mm with, at least on mid and upper ones, a small, rounded, dark, scaly bud on the acroscopic side, incipient buds also on some adaxial surfaces on costules or veins; pinnules (one pair proximal on basal and mid pinnae only) 1–3 \times 0.7–1.7 cm,



Figure 2. *Diplazium chimuense* C. D. Adams.



Figure 3. *Diplazium chiriquense* C. D. Adams.

elliptical to ovate, entire or pinnatifid to halfway to costule; other pinna-segments $0.5-2.5 \times 0.5-1$ cm, 8–10 pairs, ovate or oblong, obtuse or more usually acute, often quite strongly falcate, shortly lobed, crenate or serrulate, glabrous, herbaceous, green, weakly discoloured; veinlets in larger segments arbuscular, alternate in 4–8 pairs, the proximal often again forked; sori to 6(–8) mm, mainly on acroscopic branchlets, double and single (distally); indusia 0.6–0.8 mm wide, dark brown with paler entire undulate margins, folded back at maturity.

Paratypes. PANAMA. CHIRIQUE: along stream near trail N of Cerro Punta, terrestrial, 29 May 1970, *Croat 10449* (MO); Guadalupe, Cerro Punta, Finca Maduro, terrestrial, 2,000 m, Mar.–Apr. 1982, *Caballero 81, 137, 138* (MO).

This fern has the affinity of *D. franconis* but the stipe distally and the rachis are brown rather than straw-colored and much more scaly; the pinnae have fewer (7–11 instead of 13–15 or more) pairs of pinnules or pinnular segments, and the mid and upper pinnae bear small, dark, scaly buds near their bases on the acroscopic side.

Diplazium croatianum C. D. Adams, sp. nov.
TYPE: Panama. Coclé: La Mesa, above El Valle de Anton, ca. 2 km W of Cerro Pilón, on slopes

of steep knifelike ridge, cloud forest, terrestrial, 900–930 m, 22 July 1976, *Croat 37501* (holotype, MO). Figure 4.

Affinis *D. diplazioidis* (Desr.) Alston sed indusiis pallidis (non atrobrunneis) margine ciliis multo longioribus (ca. 1 mm) quam membranae basalis latitudine (ca. 0.3 mm) instructo differt.

Rhizome unknown; scales (on petiole base) $3-6 \times 1-2$ mm, elongate-deltate, acuminate to slender curled tips, denticulate-margined, black, shiny, clathrate; leaves to 145 cm long; petiole 60 cm long, brownish black, shiny, minutely puberulous; blade 85×50 cm, 2-pinnate-pinnatifid, deltate; rachis, costae and costules dark brown to black with numerous hair-tipped, sinuate, toothed scales, puberulous at least on major axes abaxially, glabrescent, shiny; adaxial groove glabrous or thinly scaly, the wings interrupted and lobed at junctions; pinnae to 30×13 cm, ca. 10 pairs, subopposite, ovate-lanceolate, equilateral, stalked to 2 cm; pinnules to 6×2 cm, to ca. 12 pairs, shortly stalked, lanceolate, the proximal slightly shorter, alternate, cut $\frac{2}{3}-\frac{3}{4}$ to the costule into 5–9 pairs of sessile segments; ultimate segments to ca. 8×3.5 mm, the basal basiscopic usually the largest, oblong, patent or antrorse, repand or crenulate, glabrous, membranaceous, scarcely discoloured; veinlets to 5 pairs in

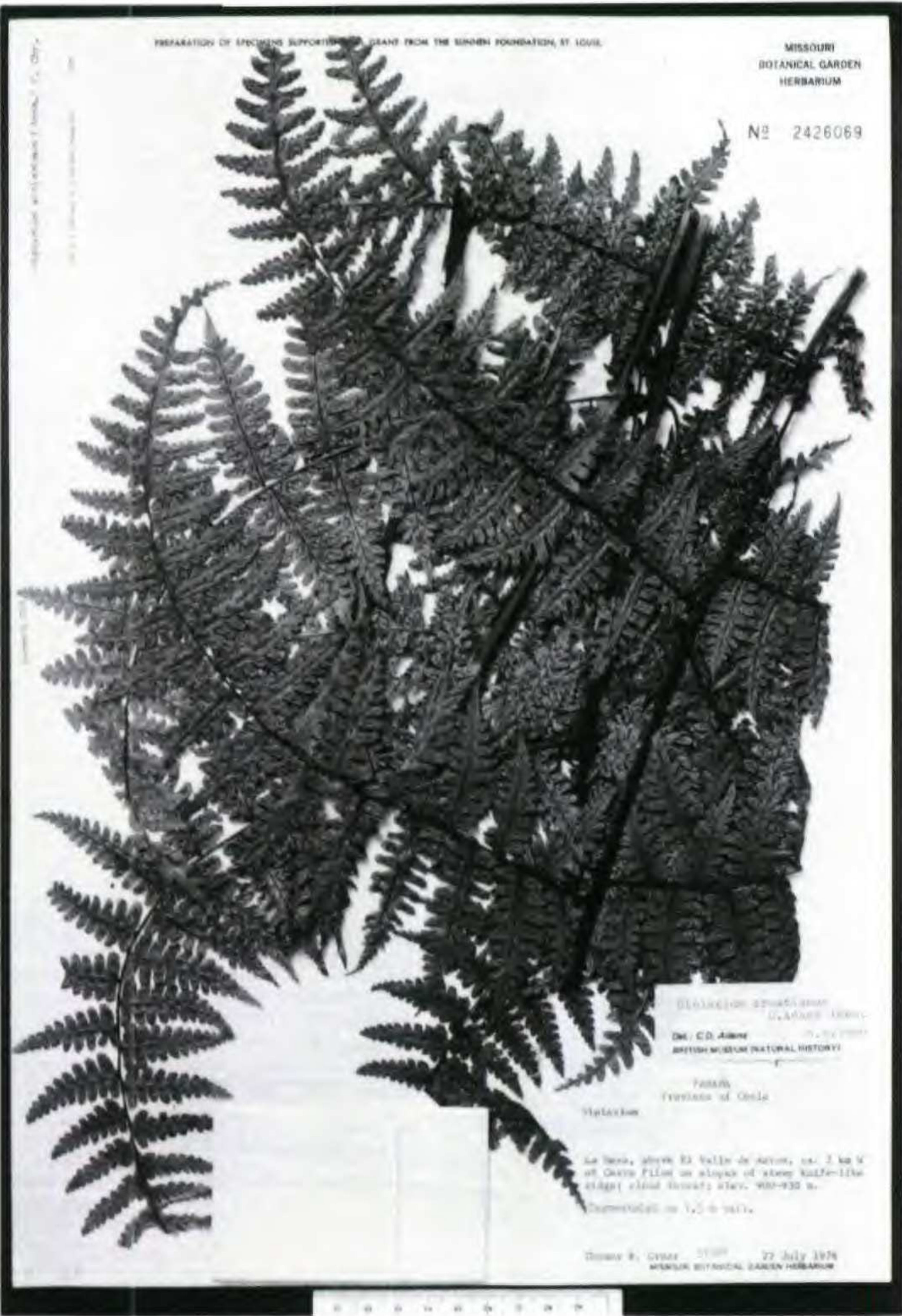


Figure 4. *Diplazium croatianum* C. D. Adams.



Figure 5. *Diplazium gomezianum* C. D. Adams.

the larger segments, simple, widely divaricate, black, ending in hydathodes mostly reaching the margin; sori very small (to ca. 3 mm) with 2 or 3 sporangia each; indusia to 0.3 mm wide with membranous light brown base and fimbriate margin with curled, septate cilia to 1 mm long.

Besides its affinity with *D. diplazioides*, this species also comes close to the recently described *D. entecnum* Mickel & Beitel (1988: 154), but proliferating buds at the bases of some of the pinnules are lacking and the uncut part of the indusia is much narrower. *Diplazium laciniatum* Mickel & Beitel (1988: 156) is also close, but the pinnae of that species have much shorter stalks, and the axes are not puberulous.

***Diplazium gomezianum* C. D. Adams, sp. nov.**

TYPE: Costa Rica. Puntarenas: road to Puerto Jiménez, Osa, 40 km W of I.A. route 2, 100 m, Gómez 19533 (holotype, MO). Figure 5.

Filix *D. herbacei* Fée affinis sed foliorum axibus pubescentibus squamatisque, pinnulis subsessilibus, segmentis majoribus petiolulis brevioribus insidentibus, hydathodis a margine remote terminantibus, indusiis integris vel subintegris (nec fimbriato- nec glanduloso-marginatis) differt.

Rhizome shortly creeping; scales to 15×0.5 – 1.5 mm, linear, long-attenuate, tapered to one cell or pair of cells, subentire, remotely denticulate, brown, shiny, subclathrate; leaves 1.5–3 m long or more; petiole 50–120 cm long or more, slightly darker, pubescent and scaly at base; pneumatophores white; rachis and costae with small dark brown scales; minor axes chaffy with hairlike, ragged or stelliform scales and minute reddish glandular hairs; blade 100–150 \times 75–100 cm or larger, 3-pinnate-pinnatifid, ovate; adaxial groove puberulous proximally, glabrous distally, with wings interrupted and shortly lobed at junctions, thinly herbaceous, uniformly green; pinnae 30–60 \times 12–30 cm, the basal slightly shorter, alternate from purplish pulvini, equilateral with stalks to 3 cm, ovate to oblong-ovate, acute; pinnules to 15 \times 4 cm, 14–20 pairs, fully pinnate with short stalks or more usually sessile with continuous lamina, less than 2 cm apart, perpendicular to the costa, oblong-lanceolate, acuminate; divisions of the third order 10–20 \times 5–8 mm, 8–12 pairs, obliquely oblong, adnate at unequal attachment to costule, with a cleft sinus on acroscopic base and a lobe to 3 \times 2.5 mm, and a rounded sinus at basiscopic base, with 5–7 pairs of rounded, doubly crenate, slightly oblique lobes

cut one-third to nearly halfway to midvein; veinlets 1–2(–3)-forked in each segment-lobe; sori to 4 mm, up to 7 pairs in each segment, double on proximal veinlet and acroscopic branch, single distally; indusia 0.3 mm wide, oblong, brown, entire or subentire, perpendicular at maturity.

Paratypes. MEXICO. CHIAPAS: Finca Mexiquito, July 1913 (st), *Purpus* 7112 (UC). COSTA RICA. La Palma, 1,500 m, 24 Sep. 1905, *Werckle* 17103 (P). PUNTARENAS: Cantón de Buenos Aires Ujarrás, headwaters of Río Kuyé following the ridges that overlook Olán, 9°17'50"N, 83°14'45"W, 1,450 m, 20 Sep. 1989, *Herrera* 3507 (CR not seen, MO).

Some Central American collections have been identified as *D. herbaceum* Fée (Smith, 1981: 96). That Brazilian plant differs in several respects, particularly in having the stipe, rachis, and minor axes glabrous, the pinnules longer-stalked, the ultimate segments smaller and more distinctly stalked, the hydathodes reaching to or very close to the margins, and the indusia being fimbriate-ciliate and glandular-margined.

Diplazium hammelianum C. D. Adams, sp. nov.

TYPE: Panama. Bocas del Toro: La Fortuna area, ca. 2 mi. N of continental divide, in forest along stream and on ridge above road, 8°46'N, 82°15'W, 950–1,100 m, 7 Mar. 1986, *Hammel et al.* 14659 (holotype, MO). Figure 6.

Filix *D. gomeziani* C. D. Adams affinis sed laminae textura membranacea (non herbacea), divisionibus pinnatifidis ordinis tertii duplo longioribus sesquialtoribusque, segmentis oblongis (non rotundatis) fere ad costulas incisiss differt.

Rhizome shortly creeping, ascending; scales to 10 × 3 mm, lanceolate, long-attenuate to a hairlike tip terminated by a knot of cells, subentire or irregularly lobed, not toothed, light tan to yellowish brown, very shiny, subclathrate, not retiform; leaves ca. 2 m long; petiole 85 cm long, not much darkened at scaly base, glabrous, into rachis stramineous and sparsely puberulous; costae and costules with a few small, ragged, appressed scales abaxially; blade 110 × ca. 90 cm, 3-pinnate-pinnatifid to nearly 4-pinnate, broadly ovate, openly divided, membranaceous, dark green; adaxial groove minutely puberulous proximally, glabrous distally, the wings interrupted and shortly lobed at junctions; pinnae to 60 × 30 cm, to ca. 11 pairs, alternate from purplish pulvini, to ca. 9 cm apart on rachis, equilateral with stalks to 8 cm long, ovate, acute; pinnules to 18 × 8 cm, ca. 12 pairs, alternate to 2–2.5 cm apart on the costa, stalked to ca. 8 mm or less, oblong-lanceolate, acuminate; divisions of the third order

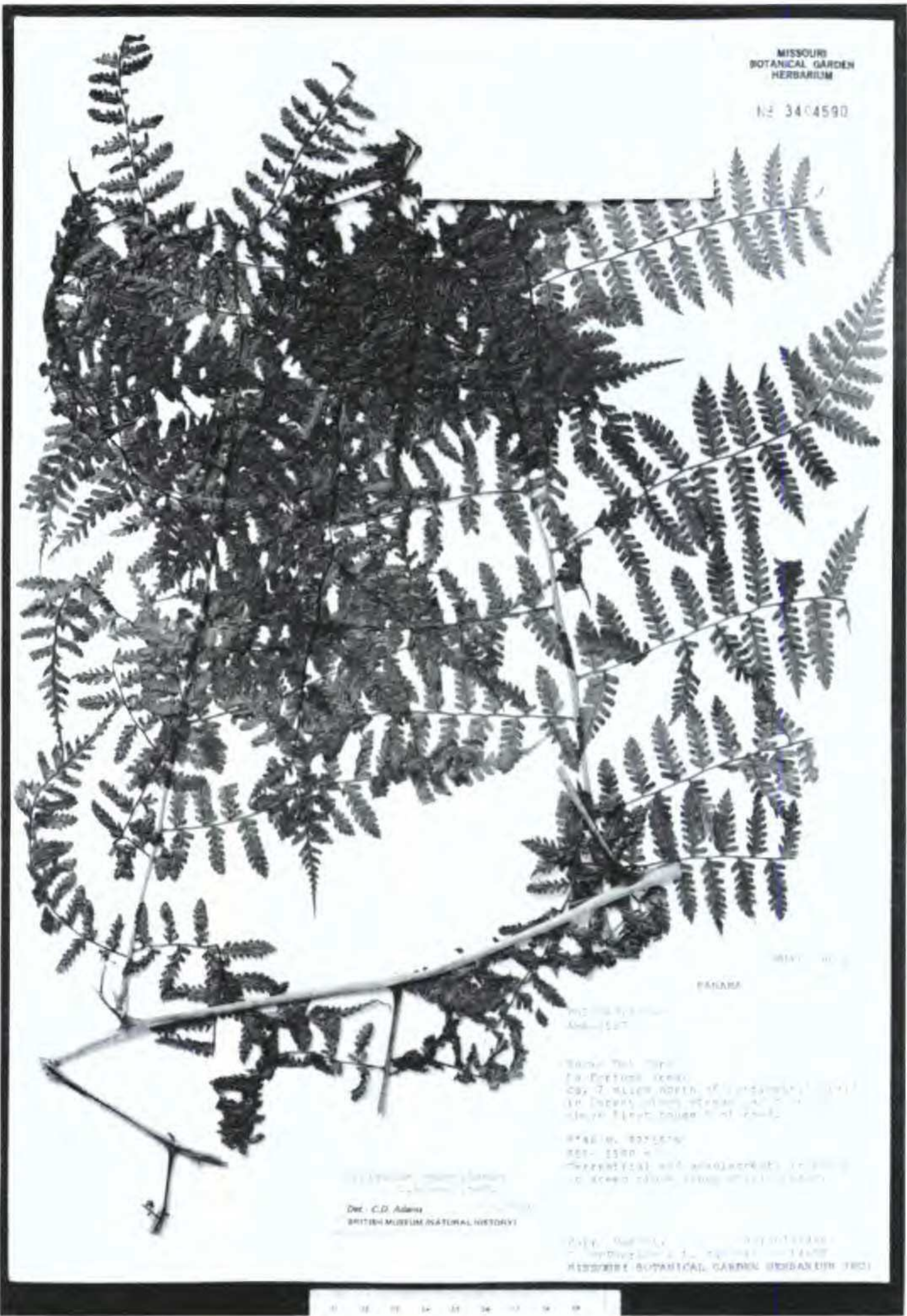


Figure 6. *Diplazium hammelianum* C. D. Adams.

1–4 × 0.7–1.2 cm, up to 4–10(–12) pairs, the proximal stalked, oblong, acuminate, cut over half-way or nearly to the midrib into alternate segments, the lamina continuous to the costa but not to its base; ultimate segments 3–7 × 2–2.5 mm, 7–9 pairs, oblong, oblique, crenate-serrate; veinlets (2–) 4–5(–6)-forked in the segments, strongly antrorse; sori 1–4 mm, single on the acroscopic veinlets; indusia 0.2 mm wide, tapered at both ends, dark yellowish brown, entire.

Diplazium hammelianum is a large fern resembling *D. gomezianum* C. D. Adams but with the texture of the lamina tissue membranaceous rather than herbaceous and the pinnatifid divisions of the third order being about twice as long and half again as wide with oblong rather than rounded segments cut nearly to the midvein.

Diplazium matudae C. D. Adams, sp. nov. TYPE:

Mexico. Chiapas: Escuintla, near Col. Zintalapa, in shaded brookside, 160 m, 23 July 1948, *Matuda* 18164 (holotype, MEXU). Figure 7.

Affinis *D. biolleyi* Christ sed pinnulis basalibus tantum penitus serrato-crenatis vel minus quam 1/3 ad costulam

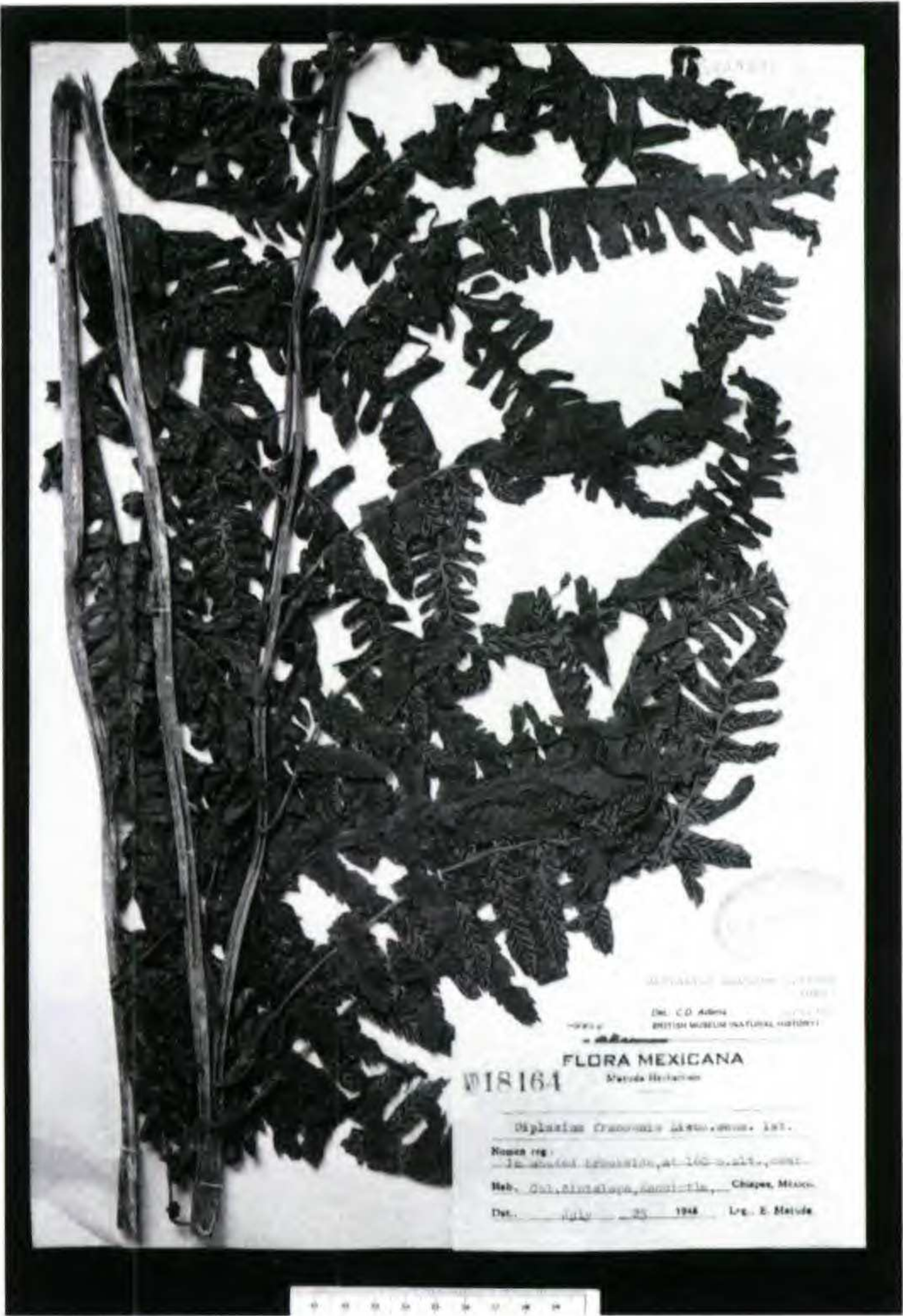


Figure 7. *Diplazium matudae* C. D. Adams.

divisis; squamis ad apicem piliformibus paucis vel absentibus differt.

Rhizome unknown; scales on base of petiole 3–7 × 2–3 mm, appressed, deltate, entire, brown, clathrate, becoming retiform and lacerate; leaves 150–160 cm long, slightly dimorphic; petiole 50–65 × 0.7–0.9 cm, brownish-stramineous, pubescent with appressed septate hairs, glabrescent; blade 90–100 × 45–50 cm, 2-pinnate-pinnatifid, ovate-lanceolate, pinnatifid and long-acuminate at tip; rachis, costae and costules with few scattered, thin, ragged or twisted, hair-tipped, small, paler brown scales and numerous patent, septate, pale or brownish hairs, light brown to stramineous, scarcely darker at junction with pinnae; adaxial groove densely puberulous, with narrow membranous, brownish wings interrupted and shortly lobed at junctions; pinnae 7–30 × 1.5–9 cm, the basal slightly shorter with stalks to 7 mm, 11–14 pairs, equilateral, lanceolate to oblong-lanceolate, long-acuminate and serrate at tip; pinnules 1.5–4 × 0.7–1.5 cm, larger on sterile leaves, ca. 12–18 pairs, all sessile except 1 or 2 proximal often shorter and only narrowly adnate, lanceolate or oblong, the larger cut at base 1/3 or less into 1 or 2 pairs of prominent lobes, elsewhere crenate to serrulate, adaxially with a few erect sep-

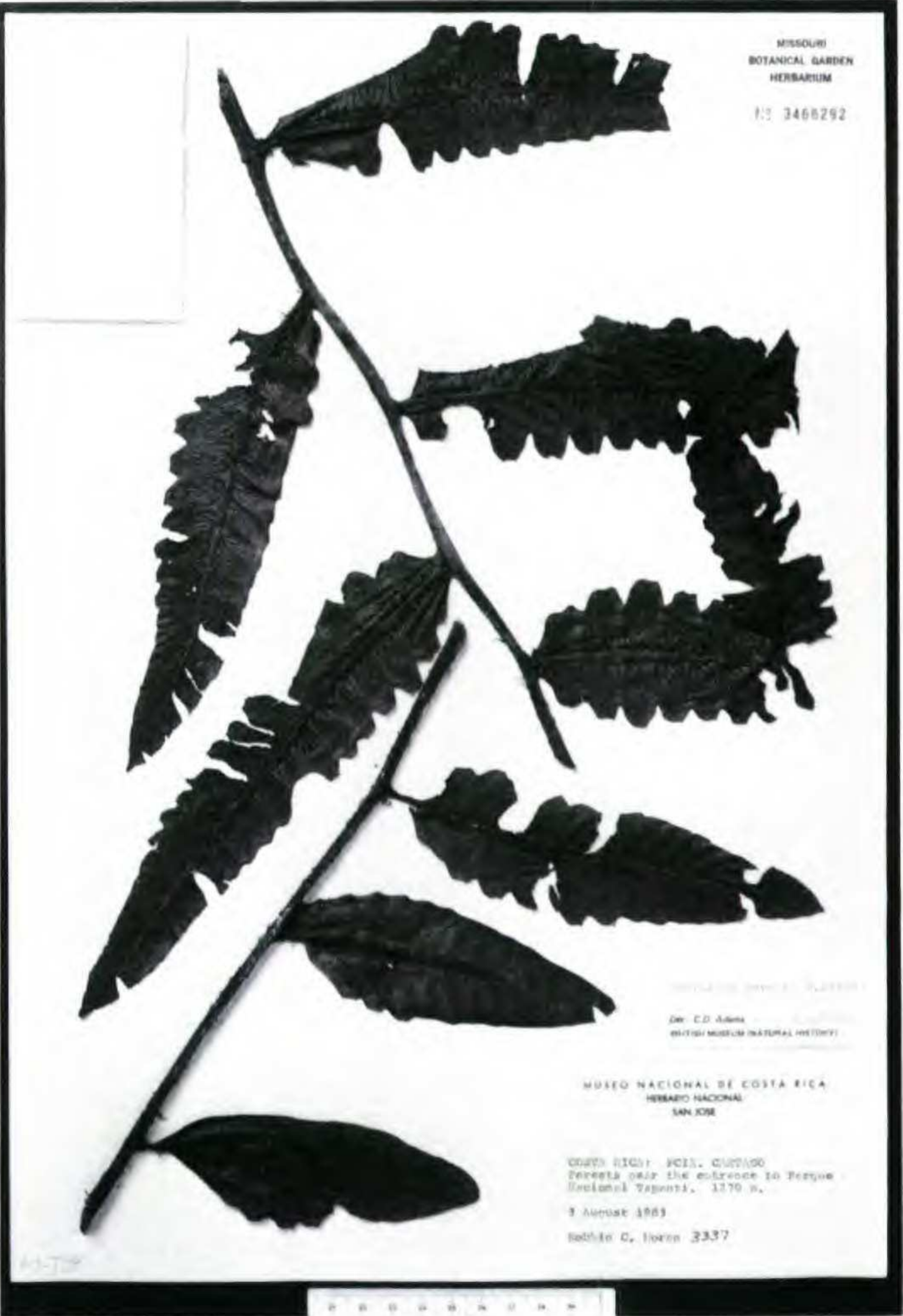


Figure 8. *Diplazium moranii* C. D. Adams.

tate hairs along costae and near bases of sinuses, abaxially with uniform erect, paler, septate hairs, firmly herbaceous, green, scarcely discolorous; veinlets to ca. 13 pairs in the larger pinnules, each branch again 1–4-forked; sori 2–8 mm, mostly diplazoid, single only distally; indusia 0.3–0.6 mm wide, subentire, without or only very rarely with short cilia, thin, hyaline or brown, folded upwards and backwards and fragmenting at maturity.

Paratype. MEXICO. GUERRERO: along Highway 125 between Pinotepa Nacional and Tlaxiaco, ca. 8.4 mi. S of Putla de Guerrero, ca. 1,000 m, 16 Jan. 1979, *Croat* 45808 (fertile) (MO), 45808A (almost all sterile) (MO).

Diplazium matudae is a medium-sized fern close to *D. biolleyi* but with the basal pinnules at most deeply serrate-crenate or divided less than one-third to the costule; hair-tipped scales few or wanting.

***Diplazium moranii* C. D. Adams, sp. nov. TYPE:** Costa Rica. Cartago: forests near the entrance to Parque Nacional Tapantí, 1,270 m, 3 Aug. 1983, *Moran* 3337 (holotype, MO). Figure 8.

Filix *D. atirrensis* (J. D. Smith) Lellinger affinis sed ad basim apicis pinnatifidi sinibus magis dilatatis (latitudine dimidium loborum contiguorum latitudinis excedentibus), pinnis lateralibus latitudine 5 cm raro attigentibus differt.

Rhizome unknown; scales (on petiole-base) to 12×1.5 mm, elongate-deltate, slightly twisted, yellow-brown, minutely forked-toothed along black sclerotic margins; leaf 170 cm long; petiole 60 cm long, brownish, scaly and thinly puberulous at base, becoming more densely so into rachis and costae abaxially, this mixed indumentum extending to veinlets and thinly, with minute forms of scales and hairs, to lamina; blade 110×36 cm, 1-pinnate-pinnatifid, oblong-lanceolate, narrowed at base, with deeply pinnatifid acuminate apex, thinly coriaceous, discoloured; adaxial midribs glabrous, without wings; free pinnae $11-17 \times \text{ca. } 4$ cm, 2 pairs, ovate-lanceolate, entire or subentire, with stalks 2-6 mm long; sessile pinnae $16-22 \times 3-5$ cm, 4 pairs, linear-lanceolate, subequilateral at narrowed cuneate base, crenate to shallowly pinnatifid with rounded lobes cut one-third to costa, shortly acuminate to an entire tip, the margin a narrow continuous band of translucent tissue; apical segments $1.5-15 \times 1.5-3$ cm, ca. 9 pairs, the larger linear, entire, widely spaced, slightly falcate, broadened at base to an interconnecting narrow wing; veinlets in pinnate groups, (1-)4-10-forked, strongly divergent proximally, subparallel distally, with intercostal anastomoses forming flat areoles along the winged rachis distally, otherwise generally free; sori double, continuous along all veinlets except close to lamina margin; indusium wanting.

This species is quite close to *D. atirrense*, but the sinuses at the base of the pinnatifid apex are wider, being more than half the width of the adjacent lobes, and the width of the lateral pinnae is rarely as much as 5 cm.

***Diplazium panamense* C. D. Adams, sp. nov.**

TYPE: Panama. Chiriquí: along trail between N fork of Río Palo Alto and Cerro Pate Macho, ca. 6 km NE of Boquete, $8^{\circ}48'N$, $82^{\circ}23.5'W$, montane rainforest and cloud forest, 1,600-2,000 m, 6 Feb. 1986, *Smith et al. 2351* (holotype, UC). Figure 9.

Filix *D. palmensis* Rosenstock affinis sed laminae apice pinnatifido, pinnis in paria 12-14 (non 2-9) dispositis, costis venisque inferne appresso-pubescentibus differt.

Rhizome to 8×1.5 cm, erect; scales $6-10 \times 2-2.5$ mm, lanceolate, twisted, subentire, irregularly denticulate, brown, lustrous, clathrate; leaves 70-100 cm long, loosely fasciculate, dimorphic (the sterile with wider pinnae); petiole 25-37 cm long, dark brown or blackish and scaly at base, dark brown and densely puberulous with septate hairs into the rachis; blade $45-60 \times 15-20$ cm, 1-pinnate, ovate-lanceolate, scarcely narrowed at base, pinnatifid at

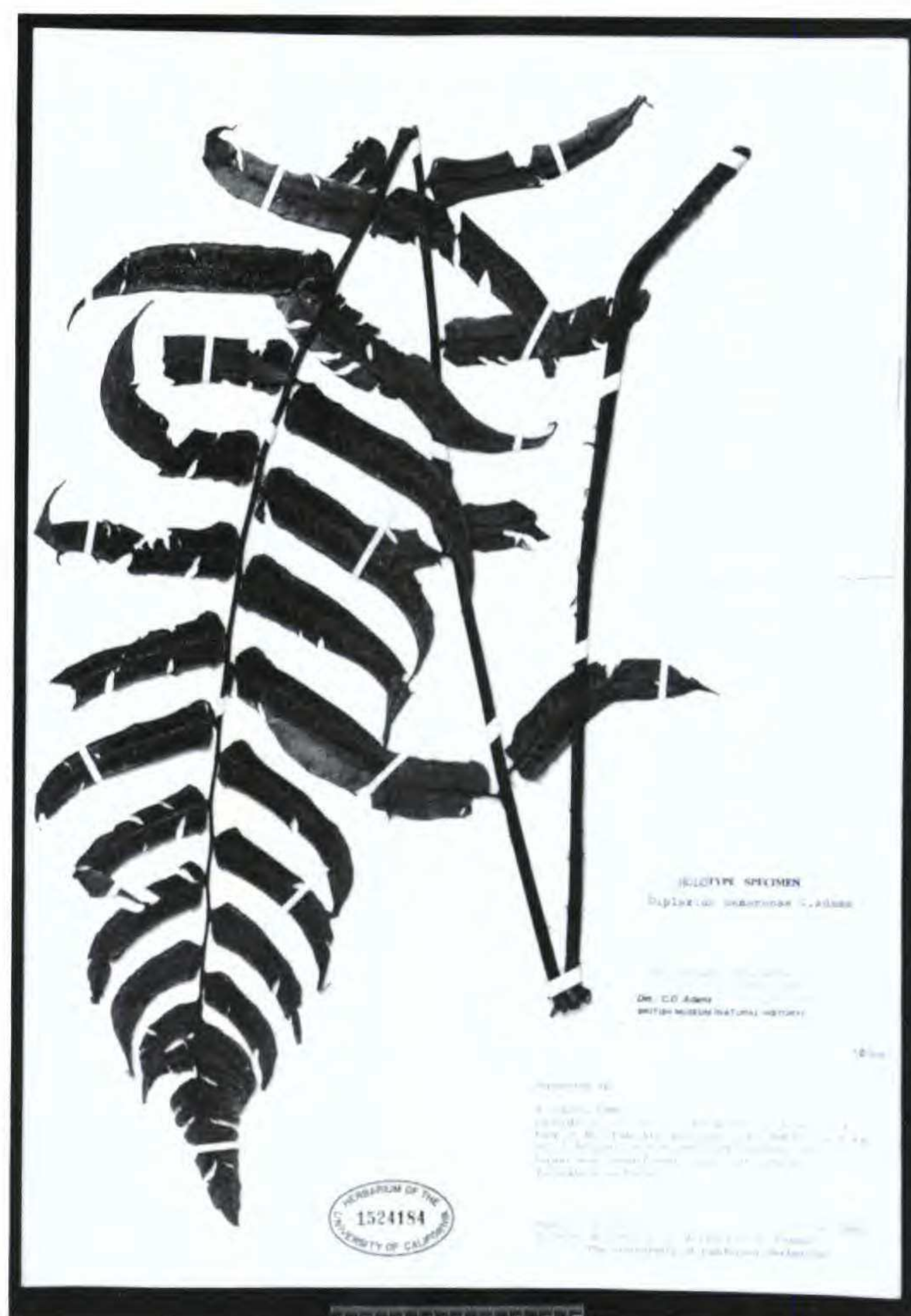


Figure 9. *Diplazium panamense* C. D. Adams.

apex; adaxial groove glabrescent; lateral pinnae $4-10 \times 1-2.8$ cm, in 12-14 alternate or subopposite pairs, 4.5-8 cm apart at base of rachis, with stalks obsolete or 2-3 mm long on fertile leaves, oblong to linear-lanceolate, subequal and truncate or subcordate-hastate at base, entire or subentire, falcate and abruptly acuminate and scarcely serrulate at tip, subcoriaceous with shortly recurved margins when dry, dark green, slightly discoloured; upper pinnae sessile or shortly adnate, without axillary buds; costae and veins abaxially with brown appressed hairs; veinlets branched from close to the costae, 2-3(-4) forked, subparallel, slightly curved close to the margin; sori 2-8 mm, irregularly diplazioid in both acroscopic and basisopic branches; indusia ca. 0.3 mm wide, dark brown, erose, ciliate, perpendicular to the lamina at maturity.

Paratype. PANAMA. CHIRIQUI: humid forest between Alto de las Palmas and top of Cerro de la Horqueta, 2,100-2,268 m, 18 Mar. 1911, *Maxon 5520* (BM).

This species has affinity with *D. palmense* but the tip of the blade is pinnatifid rather than comprising a more or less conform terminal pinna; the lateral pinnae are more numerous; and the costae and veins are appressed-pubescent abaxially.



Figure 10. *Diplazium tutense* C. D. Adams.

Diplazium tutense C. D. Adams, sp. nov. TYPE: Panama. Veraguas: above Santa Fé beyond Escuela Agrícola Panamericana, 1.8 mi. beyond fork in road on Pacific slope above rocky ravine on side of Cerro Tute, 5 Apr. 1976, Croat 34219 (holotype, MO). Figure 10.

Filix *D. skutchii* Lellinger affinis sed lamina axibusque utrinque glabris vel subglabris, pinnulis basalibus minus quam $\frac{1}{3}$ ad costulam partitis, laminae textura membranacea viridique (non chartacea schistacea) differt.

Rhizome to 20×1 cm, erect; scales $10\text{--}15 \times 2\text{--}4$ mm, lanceolate, entire but soon lacerate and ragged and eventually fenestrated and retiform, not toothed, dark brown, very shiny, subclathrate with elongated cells, mixed with much smaller scales; leaves to 1 m or more long, compactly tufted; petiole 36 cm long, dark brown and covered with large and minute, hairlike scales at base, soon stramineous into rachis and costae, puberulous, glabrescent; blade 65×30 cm, 2-pinnate-pinnatifid, ovate or deltate, pinnatifid at apex to acuminate serrate tip; rachis and costae with few somewhat irregular scales with long hairlike tips, otherwise glabrous; adaxial groove

shortly puberulous, the wings interrupted but scarcely lobed at junctions; pinnae $6\text{--}17 \times 1.5\text{--}4.5$ cm, ca. 15 pairs, stalked to 7 mm at subequal darker base, the lower slightly shorter, the upper shortly adnate at equally truncate base, linear- to oblong-lanceolate, uniformly cut to within 2–3 mm of the costa; pinnules at base of blade to ca. 2.5×1 cm, free from one another except by a very narrow strip of lamina tissue, rarely almost stalked and smaller in proximal positions, to 12–14 pairs, oblong, patent or antrorse, reduced toward apex of blade to ca. 5×5 mm, $\frac{1}{3}$ to midvein or less, crenate-serrate laterally, dentate at tip, glabrous on both surfaces, membranaceous, green, discolorous; veinlets in larger segments 7–9 pairs, divergently 2–3-forked proximally, simple distally, remote below sinuses; sori to 4 mm, to 6–7 pairs along acroscopic veinlet-branches; indusia 0.5–0.7 mm wide, pale brown or hyaline, translucent, entire or subentire, without cilia, fragile and fragmenting at maturity.

This medium-sized fern resembles *D. skutchii*, but the blade and axes are glabrous or nearly so on both surfaces; the basal pinnules are lobed less than one-third of the way to the costule; and the lamina tissue is membranous and green rather than chartaceous and grayish.

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